CLAIMS

What is claimed is:

1. A multiplexer switch comprising:

at least one field effect transistor having a current channel connected in series with a signal line that penetrates a tank containing a potentially explosive environment;

an isolation circuit; and

a drive circuit coupled to said at least one field effect transistor through said isolation circuit for operating said current channel thereof, said isolation circuit electrically isolating said drive circuit from said at least one field effect transistor to limit energy coupled to said signal line through said at least one field effect transistor to below levels that could initiate an ignition of the potentially explosive environment of the tank.

2. The switch of claim 1 wherein the at least one field effect transistor comprises a source junction and a drain junction connected in series with the signal line; and wherein the output of the isolation circuit is coupled across a gate junction and the source junction of the at least one field effect transistor to permit operation of the current channel thereof by the drive circuit.

3. The switch of claim 2 wherein the isolation circuit comprises an optical isolator circuit.

4. The switch of claim 3 wherein the optical isolator circuit comprises at least one light emitting diode coupled to the drive circuit and a light detecting circuit for applying a voltage across the gate and the source junctions of the at least one field effect transistor to permit operation of the current channel thereof in response to light received from the light emitting diode.

5. The switch of claim 5 wherein the at least one field effect transistor comprises a series connected plurality of metal oxide semiconductor field effect transistors effecting low conducting resistance.

6. The switch of claim 1 including:

a second at least one field effect transistor having a current channel connected to the signal line downstream of the at least one field effect transistor and at a point before the signal line penetrates the tank;

a second isolation circuit; and

a second drive circuit coupled to said second at least one field effect transistor through said second isolation circuit for operating said current channel thereof, said second isolation circuit electrically isolating said second drive circuit from said second at least one field effect transistor to limit energy coupled to said signal line through said second at least one field effect transistor to below levels that could initiate an ignition of the potentially explosive environment of the tank.

7. The switch of claim 6 wherein the at least one field effect transistor couples an intrinsically safe circuit to a sensor in the tank through the signal line; and wherein the second at least one field effect transistor couples the signal line to a common voltage potential.

8. The switch of claim 7 including a logic circuit for controlling the respective drive circuits of the at least one field effect transistor and the second at least one field effect transistor in a complementary fashion.

9. The switch of claim 6 wherein the at least one field effect transistor couples a first intrinsically safe circuit to a sensor in the tank through the signal line; and wherein the second at least one field effect transistor couples a second intrinsically safe circuit to the sensor through the signal line.

10. The switch of claim 9 including a logic circuit for controlling the respective drive circuits of the at least one field effect transistor and the second at least one field effect transistor in a complementary fashion.

11. A multiplexing system for a plurality of sensors disposed in a tank containing a potentially explosive environment and excited from a common excitation circuit outside of said tank through a corresponding plurality of signal lines that penetrate said tank, said system comprising:

a multiplexer switch for each sensor, each multiplexer switch disposed outside of said tank in series with the corresponding signal line between said common excitation circuit and said corresponding sensor in the tank, each multiplexer switch comprising:

at least one field effect transistor having a current channel connected in series with said corresponding signal line;

an isolation circuit; and

a drive circuit coupled to said at least one field effect transistor through said isolation circuit for operating said current channel thereof, said isolation circuit electrically isolating said drive circuit from said at least one field effect transistor to limit energy coupled to said corresponding signal line through said at least one field effect transistor to below levels that could initiate an ignition of the potentially explosive environment of the tank.

12. The system of claim 11 including a second multiplexer switch for each sensor, each second multiplexer switch disposed outside of said tank and coupled between the corresponding signal line at a point before the signal line penetrates the tank and a common voltage potential, each second multiplexer switch comprising:

a second at least one field effect transistor having a current channel connected between the signal line downstream of the at least one field effect transistor and the common voltage potential;

a second isolation circuit; and

a second drive circuit coupled to said second at least one field effect transistor through said second isolation circuit for operating said current channel thereof, said second isolation circuit electrically isolating said second drive circuit from said second at least one field effect transistor to limit energy coupled to said signal line through said second at least one field effect transistor to below levels that could initiate an ignition of the potentially explosive environment of the tank.

13. The system of claim 12 including a logic circuit for controlling the respective drive circuits of the at least one field effect transistor and the second at least one field effect transistor in a complementary fashion.

14. The system of claim 12 including a third multiplexer switch disposed outside of said tank in series with a second signal line coupling a primary response circuit to the plurality of sensors in the tank, each third multiplexer switch comprising:

a third at least one field effect transistor having a current channel connected in series with said second signal line;

a third isolation circuit; and

a third drive circuit coupled to said third at least one field effect transistor through said third isolation circuit for operating said current channel thereof, said third isolation circuit electrically isolating said third drive circuit from said third at least one field effect transistor to limit energy coupled to said second signal line through said third at least one field effect transistor to below levels that could initiate an ignition of the potentially explosive environment of the tank.

15. The system of claim 14 including a fourth multiplexer switch disposed outside of said tank in series with a third signal line coupling a secondary response circuit to the plurality of sensors in the tank, each fourth multiplexer switch comprising:

a fourth at least one field effect transistor having a current channel connected in series with said third signal line;

a fourth isolation circuit; and

a fourth drive circuit coupled to said fourth at least one field effect transistor through said fourth isolation circuit for operating said current channel thereof, said fourth isolation circuit electrically isolating said fourth drive circuit from said fourth at least one field effect transistor to limit energy coupled to said third signal line through said fourth at least one field effect transistor to below levels that could initiate an ignition of the potentially explosive environment of the tank.

16. The system of claim 15 including a logic circuit for controlling the respective drive circuits of the third at least one field effect transistor and the fourth at least one field effect transistor in a complementary fashion.

17. The system of claim 15 including a fifth for each sensor, each fifth multiplexer switch disposed outside of said tank in series with a corresponding fourth signal line coupled between a secondary common excitation circuit and the corresponding sensor in the tank, each fifth multiplexer switch comprising:

a fifth at least one field effect transistor having a current channel connected in series with said corresponding fourth signal line;

an fifth isolation circuit; and

a fifth drive circuit coupled to said fifth at least one field effect transistor through said fifth isolation circuit for operating said current channel thereof, said fifth isolation circuit electrically isolating said fifth drive circuit from said fifth at least one field effect transistor to limit energy coupled to said corresponding fourth signal line through said fifth at least one field effect transistor to below levels that could initiate an ignition of the potentially explosive environment of the tank.

18. The system of claim 17 including a sixth multiplexer switch for each sensor, each sixth multiplexer switch disposed outside of said tank and coupled between the corresponding fourth signal line at a point before the signal line penetrates the tank and the common voltage potential, each sixth multiplexer switch comprising:

a sixth at least one field effect transistor having a current channel connected between the corresponding fourth signal line downstream of the sixth at least one field effect transistor and the common voltage potential;

a sixth isolation circuit; and

a sixth drive circuit coupled to said sixth at least one field effect transistor through said sixth isolation circuit for operating said current channel thereof, said sixth isolation circuit electrically isolating said sixth drive circuit from said sixth at least one field effect transistor to limit energy coupled to said corresponding fourth signal line through said sixth at least one field effect transistor to below levels that could initiate an ignition of the potentially explosive environment of the tank.

19. The system of claim 18 including a logic circuit for controlling the respective drive circuits of the fifth at least one field effect transistor and the sixth at least one field effect transistor in a complementary fashion.

20. The system of claim 18 including a logic circuit for enabling operation of the multiplexer switches and second multiplexer switches when the common excitation circuit is in use and for enabling operation of the fifth multiplexer switches and sixth multiplexer switches when the secondary common excitation circuit is in use.

21. The system of claim 18 wherein the at least one field effect transistor of each of the multiplexer switches comprises a source junction and a drain junction connected in series with the corresponding signal line; and wherein each of the isolation circuits includes an output coupled across a gate junction and the source junction of the corresponding at least one field effect transistor to permit operation of the current channel thereof by the corresponding drive circuit.

22. The system of claim 21 wherein each of the isolation circuits comprises an optical isolator circuit.

23. The system of claim 22 wherein each optical isolator circuit comprises at least one light emitting diode coupled to the corresponding drive circuit and a light detecting circuit for applying a voltage across the gate and source junctions of the corresponding at least one field effect transistor to permit operation of the current channel thereof in response to light received from the light emitting diode.

24. The system of claim 23 wherein each of the multiplexer switches comprises a series connected plurality of metal oxide semiconductor field effect transistors effecting low conducting resistance.

25. The system of claim 18 wherein the tank contains a combustible liquid; and wherein each sensor of the plurality is operative in response to an excitation signal to generate a response signal representative of a parameter measurement of the combustible liquid.

26. The system of claim 18 wherein the tank comprises an aircraft fuel tank containing aircraft fuel; and wherein each sensor of the plurality is operative in response to an excitation signal to generate a response signal representative of the level of the aircraft fuel in the tank.

27. The system of claim 26 wherein each sensor comprises a capacitive fuel level measurement sensor.

28. The system of claim 18 wherein the common excitation circuit, secondary excitation circuit, primary response circuit and secondary response circuit are all intrinsically safe circuits.

29. A method of multiplexing an excitation signal from a common excitation circuit to a plurality of sensors disposed in a tank containing a potentially explosive environment, said method comprising the steps of:

disposing a multiplexer switch is series with each signal line coupling a corresponding sensor of said plurality to said common excitation circuit outside of said tank;

isolating each multiplexer switch from a corresponding drive circuit to limit energy coupled to said corresponding signal line through said corresponding multiplexer switch to below levels that could initiate an ignition of the potentially explosive environment; and

controlling the drive circuits to multiplex the excitation signal from the excitation circuit to selected sensors of said plurality through the corresponding multiplexer switches.

30. The method of claim 29 including the steps of:

coupling a second multiplexer switch between each signal line, at a point downstream of each multiplexer switch and before the signal line penetrates the tank, and a common potential;

isolating each second multiplexer switch from a corresponding second drive circuit to limit energy coupled to said corresponding signal line through said corresponding second multiplexer switch to below levels that could initiate an ignition of the potentially explosive environment; and

controlling the second drive circuits to couple the signal lines corresponding to the unselected sensors of said plurality to the common potential through the corresponding second multiplexer switches.

31. The method of claim 29 including the steps of:

disposing a second multiplexer switch is series with each second signal line coupling a corresponding sensor of said plurality to a secondary common excitation circuit outside of said tank;

isolating each second multiplexer switch from a corresponding second drive circuit to limit energy coupled to said corresponding second signal line through said corresponding second multiplexer switch to below levels that could initiate an ignition of the potentially explosive environment;

enabling the second drive circuits when the secondary common excitation circuit is in use; and

controlling the second drive circuits, when enabled, to multiplex the excitation signal from the secondary excitation circuit to selected sensors of said plurality through the corresponding second multiplexer switches.

32. The method of claim 29 including the steps of:

disposing a second multiplexer switch is series with a second signal line coupling the sensors of the plurality to a primary response circuit outside of said tank;

isolating said second multiplexer switch from a second drive circuit to limit energy coupled to said second signal line through said second multiplexer switch to below levels that could initiate an ignition of the potentially explosive environment; and

controlling the second drive circuit to couple a response signal from the selected sensor of the plurality to said primary response circuit through said second multiplexer switch.

33. The method of claim 32 including the steps of:

disposing a third multiplexer switch is series with a third signal line coupling the sensors of the plurality to a secondary response circuit outside of said tank;

isolating said third multiplexer switch from a third drive circuit to limit energy coupled to said third signal line through said third multiplexer switch to below levels that could initiate an ignition of the potentially explosive environment;

enabling the third drive circuit when said secondary response circuit is in use; and

controlling the third drive circuit, when enabled, to couple a response signal from the selected sensor of the plurality to said secondary response circuit through said third multiplexer switch.